

to 45 minutes after emerging, it spins a cocoon and pupates. Cocoon creamy white, oval in shape and on an average measures 3.5 mm. in length and 1.9 mm. in breadth. Pupal period varies from 5-7 days. The adult braconid cuts a hole at the anterior end of the cocoon and emerges. A single life cycle was completed in 18-21 days, and adults lived for 2-5 days. The average duration of each period recorded in 7 cases is summarised in Table 1.

TABLE 1
LIFE CYCLE AND LONGEVITY OF *Apanteles paludicolae* IN DAYS

Month	Incubation period	Larval period	Pupal period	Life cycle period	Adult longevity
October 1965..	4	9	5	18	5
November 1965	5	9	7	21	3
December 1965	5	7	6	18	2

Extent of parasitism and period of activity: Regular collection of the larvae of the pest made to note the extent of braconid parasitism revealed that it was as high as 18% during the month of October but fell to 10% and 7% during November and December 1965.

ACKNOWLEDGEMENTS

We are grateful to the Director, Commonwealth Institute of Entomology, London for identifying the parasite and to the authorities of J.N.K.V.V., Jabalpur for facilities.

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April 16, 1969.

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29. LOCALIZED MASS BREEDING OF *HAEMAPHYSALIS BISPINOSA* NEUMANN, 1897 (ACARINA, IXODIDAE) IN KYASANUR FOREST DISEASE AREA, SHIMOGA DISTRICT, MYSORE STATE, INDIA

(With two plates)

INTRODUCTION

The tick, *Haemaphysalis bispinosa* Neumann, 1897, has been recorded from different localities in India, parasitizing several species of mammals

and birds (Sharif 1928, Rajagopalan 1965, Rajagopalan *et al.* 1968). Outside the Indian continent, the species has been reported to occur in Siberia, Japan, China, Burma, Indonesia, New Zealand and Australia (Nuttall & Warburton 1915, Anastos 1950, and Kohls 1957). However, recent taxonomic studies show that *H. bispinosa* is restricted to India, Pakistan, Burma, Thailand, Malaya and Nepal. Other distribution records refer to several other species (*H. Hoogstraal*, personal communications).

Though *H. bispinosa* has been known to be a common parasite of domestic animals, information on its bionomics is very scanty. In early studies on the infestation of *Haemaphysalis spinigera* on cattle in Kyasanur Forest disease (KFD) area (Work *et al.* 1957), it was found that cattle were infested by adults and immature stages of nine species of ticks. The predominant species were : *H. spinigera*, *Boophilus microplus*, *H. bispinosa*, *Amblyomma integrum* and *Rhipicephalus haemaphysaloides*. An intensive search made in cattle sheds showed that, of the five predominant species of ticks infesting cattle, only *H. bispinosa* inhabits cattle sheds (Bhat 1968). The present communication deals with some observations on the mass breeding of the species in cattle sheds at Bhimaneri and other nearby villages in the KFD area.

OBSERVATIONS

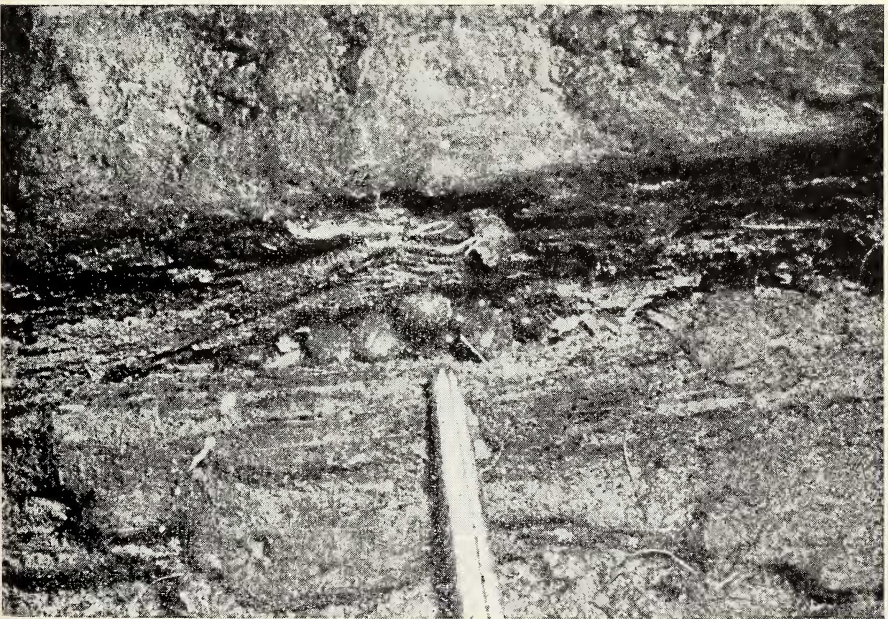
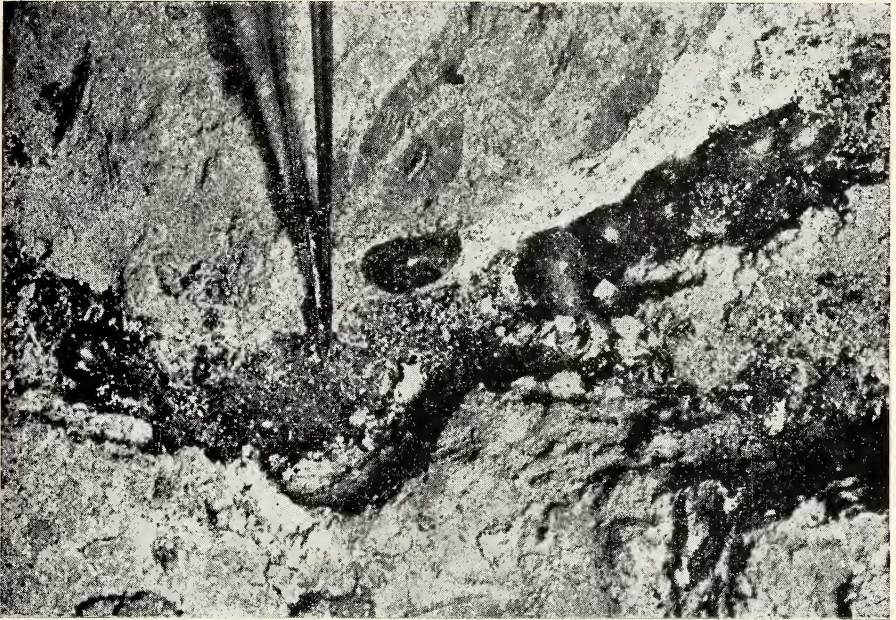
Infestation of *H. bispinosa* in a cattle shed at Bhimaneri was first observed on 14 June 1963. Subsequently the cattle shed was visited once or twice in a fortnight to study the condition of the tick population.

In June 1964, three more cattle sheds with mass breeding of *H. bispinosa* were found at Kalasi and Kamblikoppa villages about four miles from Bhimaneri. The mass breeding in these cattle sheds subsided during the summer months, from April to June 1965. When the study was discontinued in June 1965, two cattle sheds at Kaisodi village, which were clean during the previous years, were found newly infested with ticks.

All cattle sheds in which *H. bispinosa* was found breeding in a mass scale had mud walls and sugarcane leaves thatched roofs or clay tiles. They were without adequate ventilation and were practically dark inside. The other type of cattle sheds in these villages, which were the majority, were open at the sides being without walls. Some were protected with bamboo fencing. These well-ventilated sheds were free from mass breeding, though occasionally a few adults and immature stages were observed.

During the first observation at Bhimaneri in June 1963, the shed

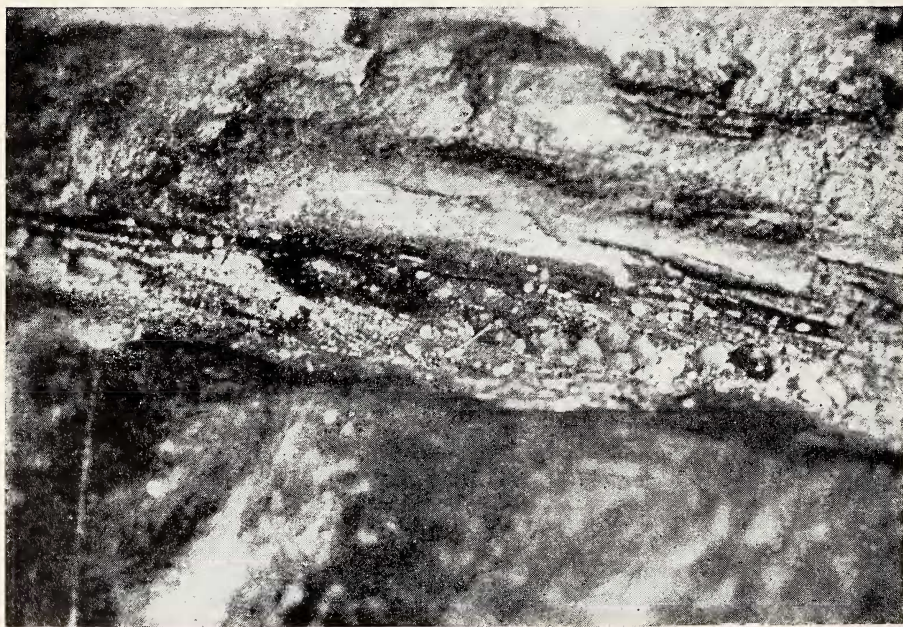
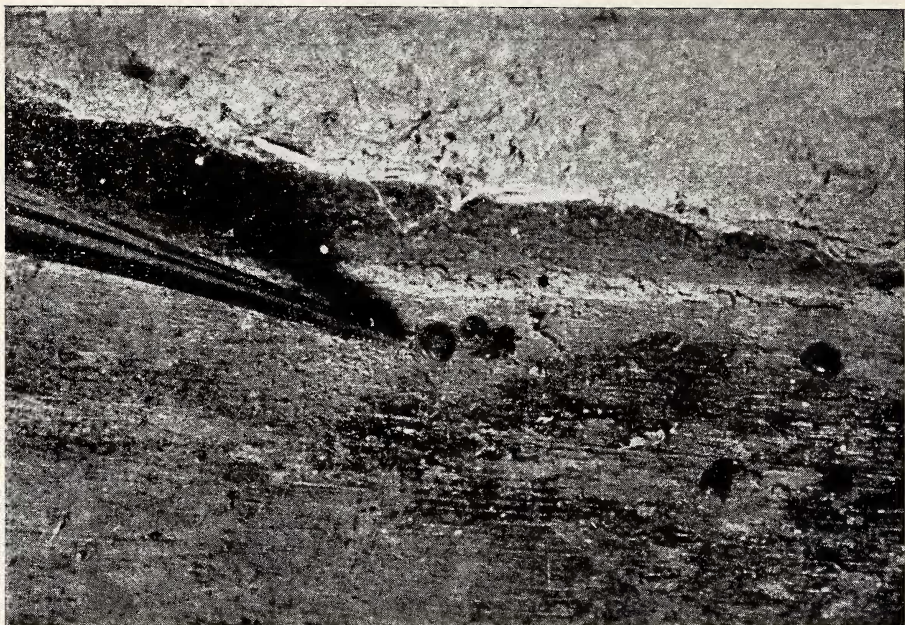
Bhat: *Haemaphysalis bispinosa*



Above : Cluster of gorged females with egg broods in a crevice on a mud-wall
Chalky white dots are tick excreta ($\times 4$).

Below : Engorged larvae and nymphs in split on wooden pillar ($\times 24$).

Bhat: *Haemaphysalis bispinosa*



Above : Engorged nymphs crawling on a wooden pillar ($\times 6$).

Below : Engorged larvae and nymphs in a split on a wooden pillar.

was infested by a small number of engorged and unengorged adults. A few engorged immature stages were also seen. In July the population of engorged adults suddenly increased. Freshly dropped and ovipositing females were seen in clusters of fifty to sixty along with egg masses inside the crevices of walls, upto three feet above the floor (Fig. 1). Engorged adults continued to appear till the end of August. From September onwards their number gradually decreased and from December to May, they were almost absent. In the next rainy season from June to September 1964, they reappeared and a similar sequence of events followed. In the rainy season of 1965, the mass breeding subsided in the shed under observation (Table 1).

About a month after the appearance of engorged adults in large numbers, larvae appeared in clusters of a few to several hundred individuals all over the walls and pillars up to five feet above the floor. Engorged larvae, unengorged and engorged nymphs, and unengorged adults appeared in succession with about 10 to 15 day intervals (Table 1). Clusters of engorged larvae and nymphs were observed in grooves and crevices of wooden pillars, walls and ropes (Figs. 4 and 5). Engorged larvae were found up to five feet and nymphs up to eight feet above the floor.

Engorged larvae, nymphs and adults dropped in large number from cattle during early morning hours (6 to 8 a.m.) and the shed was seen teeming with crawling ticks. The crawling activity subsided after about two hours as the ticks gradually settled in the crevices. A considerable number of engorged stages occurred on the hosts when they were leaving the sheds for grazing. These ticks were missing from the body of the hosts when they returned in the evening, indicating that they dropped in the forests and grazing fields.

A large number of the engorged stages were preyed upon by domestic fowls in the shed. Early in the morning fowls were seen devouring a large number of ticks, particularly engorged females, from the body of the hosts as well as from the floor of the shed. The domestic fowls appeared to be partly responsible for keeping the open sheds free from the ticks, where the light permitted them to make a thorough search for the ticks.

DISCUSSION

Unlike other species of ticks infesting cattle in the KFD area, which usually inhabit forest biotope during their nonparasitic phases, *H. bispinosa* inhabits forest, grazing field as well as cattle sheds. The mass breeding of *H. bispinosa* inside the cattle sheds appears to be due to the fact that the engorged ticks dropped during the early morning hours, before the